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ARMY MEDICAL RESEARCH LABORATORY

FORT KNOX, KENTUCKY

REPORT NO. 137

5 February 1954

EVALUATION OF THE EFFECTIVENESS OF THE PHYSICAL TRAINING PROGRAM DURING THE BASIC INFANTRY TRAINING CYCLE*

*Subtask under Human Engineering Studies, AMRL Project No. 6-95-20-001, Subtask, Field Studies.

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RESEARCH AND DEVELOPMENT DIVISION
OFFICE OF THE SURGEON GENERAL
DEPARTMENT OF THE ARMY

Army Medical Research Lab. Project No 6-95-20-001 Report No. 137

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2. Basic Infantry Training

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by

Jack, D. Reedy, Captain, M. C.

from

ARMY MEDICAL RESEARCH LABORATORY
FORT KNOX, KENTUCKY
5 February 1954

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Report No. 137
Project No. 6-95-20-001
Subtask AMRL S-5
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5 February 1954

ABSTRACT

EVALUATION OF EFFECTIVENESS OF THE PHYSICAL TRAINING PROGRAM DURING THE BASIC INFANTRY TRAINING CYCLE

OBJECT

A previous report from this laboratory indicated a need for evaluation of the effectiveness of the physical training program during the basic training cycle. The work load of the basic training itself seemed severe enough to be the chief factor in improvement in physical condition shown by most trainees, rather than the 24 periods of calisthenics normally given during the 8-week basic infantry cycle. The purpose of this subtask was to test this hypothesis.

RESULTS

A testing program composed of 4 different tests of physical condition served as the criteria of improvement in physical condition shown by a total of 1,132 basic trainees organized into 6 different training companies. Three of these companies had the usual 24 periods of physical training, and three had no formal physical training. The testing program showed no significant difference in degree of improvement between those companies with and those without physical training.

RECOMMENDATIONS

1. Further evaluation should be given to the effectiveness of the 24 periods of formal physical training normally allotted within an 8-week basic infantry cycle.
2. It is recommended that either the 24 periods of calisthenics be dropped from the physical training program, or that their intensity be increased sufficiently to produce a possible significant change in physical condition.

Submitted by:
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EVALUATION OF EFFECTIVENESS OF THE PHYSICAL TRAINING PROGRAM DURING THE BASIC INFANTRY TRAINING CYCLE

I. INTRODUCTION

An evaluation of the effectiveness of the physical training program of the 8-week basic training cycle in the Third Armored Division at Fort Knox, Kentucky was made. During a prior study (1), it was evident that the physical work-load of the military portion of the basic training cycle was very heavy--probably sufficiently heavy to be the primary influence in the improved condition normally shown by most basic trainees. In the present study a comparison was made between men who had formal physical training during the basic training cycle and those who had all the military training but had no formal physical training.

Two groups of test subjects were employed, one group having no formal physical training and a second group having the 24 periods of physical training normally incorporated in the basic infantry 8-week training cycle (2). A testing program established the subjects' condition before basic training, and during the eighth-week of basic training. These tests served as a measure of the change of physical condition occurring during the 8-week training period.

II. EXPERIMENTAL

A. Test Subjects

The test subjects were enlisted men assigned to the Third Armored Division at Fort Knox, Kentucky for basic training. These men were either inductees or voluntary enlistments who had been assigned by The Third Armored Division to take the 8-week basic infantry training cycle. The assignment was made by the Adjutant General's Classification and Assignment Section of the Third Armored Division. These men covered the usual range of physical profile acceptable for military duty. The selection was also made to cover the normal distribution of area aptitude scores. This selection procedure gave a relatively uniform group as nearly representative of the normal basic trainee as could be obtained. The test subjects were predominantly from the Great Lakes region and the upper Ohio Valley, with a small scattering of men from the entire eastern half of the United States.

There were 1132 subjects in all, divided into six training companies. Each company entered training at a different time, but followed the same training schedule. Companies 1, 2, and 5 had no formal physical training in their program; Companies 3, 4, and 6 had the usual 24 periods of formal physical training.

B. Exercise Program

No attempt was made to influence the regular prescribed exercise program in any way. Companies which included physical training in their program operated under normal training procedures the same as if there was no study being undertaken. The physical training was given by the company cadre in the normal manner, both as to type and duration. The companies who had no physical training had some shifting of class periods to provide a block of time for the end-testing during the eighth week of the cycle.

C. Duration of the Study

The first company entered training on 24 August 1953. The initial testing (pre-cycle testing period) was done on three days, 24-26 August 1953. The final company completed its end-test on 6-8 December 1953. This time interval gave a moderate differential in climate, however, companies both with and without physical training were exposed to a similar degree of weather extremes. The pre-testing was done during rather hot weather; the end-testing was done during moderately cool weather. Indoor tests were administered under controlled temperature conditions.

D. Testing Program

1. Selection of Tests

Four tests of physical fitness were used to evaluate the physical condition of the test subjects. Previous experience (1) has indicated that these four tests would best evaluate the changes to be measured.

a. The Harvard Step-Test score is based partially on the heart rate which is beyond the voluntary control of the test subject and, as such, has a tendency to eliminate the motivation factor.

b. The Army Physical Fitness Test has wide-spread recognition and use by the Army. At the present time, it is the standard test of physical fitness or condition in use through all branches of the Army.

c. The third test, a timed run over an obstacle course, proved on a previous study to be a good measure of change in physical condition as a result of training.

d. The fourth test was a Five Mile Speed March over country roads, again as a timed measure. The speed march served as a measure of the prolonged endurance improvement which is shown by most basic trainees.

2. Testing Procedure

Each test subject was given the four tests during the "fill" week, or pre-cycle week, of this military training. This was the period just preceding the commencement of formal basic training. The tests were repeated during the eighth, or final, week of training. The sequence was controlled in respect to the days on which each test was made and as to the time of day each man took the test. The First Platoon was always tested first in both pre- and end-test and, consequently, had an earlier period in the day. The Fourth Platoon was always the last to be tested each time the tests were given.

The Harvard Step Test was administered and scored in a modified form as described on page 276 of the test by Schneider and Karpovich (3, 4). The Army Physical Fitness Test was given and scored as described in FM 21-20 (5). The obstacle course was simply scored as the number of seconds required for the man to transverse a course of approximately 1200 feet, including eleven obstacles. A detailed description of the course is given in a previous report from this laboratory (1). This course was constructed so as to be a severe test of a man's physical capacity to cover the distance and overcome various obstacles in a short period of time. It was constructed with the intent of eliminating any obstacle which would scare or frighten a man, or require confidence on his part to attempt the obstacle. This was done to remove the factor of fear or skill. Some test subjects failed to negotiate all obstacles. A note was made of the number of obstacles missed. The Five-Mile March was actually five and six-tenths miles over country road. Approximately the first mile of the course was macadam pavement. The remainder was rough gravel. The course had two hills on the route, each of which had a rise and fall of about 300 feet. Men were started on the course at 30-second intervals, and told to cover the course as rapidly as possible. The score was recorded as elapsed time.

III. RESULTS

The results of the testing program are given on Tables 1 through 5. Table 1 presents the results of the Harvard Step Test. This table shows the number of test subjects in each company, the average scores on the pre-test and the end-test period, and the range. The three companies with physical training were grouped to show the combined mean scores and ranges. The mean scores for the group without physical training are slightly lower than those with physical training, however, the ranges are similar.

TABLE 1
HARVARD STEP TEST*

Companies with Physical Training							
	Company No. 3 189 Men		Company No. 4 203 Men		Company No. 6 156 Men		Combined Companies 548 Men
	Pre	End	Pre	End	Pre	End	Pre End
Average Scores	60.3	76.0	59.6	79.6	61.1	76.0	60.2 77.3
Range of Scores	15-105	15-95	20-95	35-95	20-95	30-95	15-105 15-95
Companies without Physical Training							
	Company No. 1 203 Men		Company No. 2 188 Men		Company No. 5 193 Men		Combined Companies 584 Men
	Pre	End	Pre	End	Pre	End	Pre End
Average Scores	57.4	75.3	51.5	71.2	58.8	73.5	56.0 73.4
Range of Scores	15-95	30-95	15-105	30-105	20-95	25-95	15-105 25-105

*The scores are abstract figures from a prepared chart and are determined from the duration of exercise and heart rate after exercise. Possible range of scores is from 0-130.

The results of the Army Physical Fitness Test are presented in Table 2. The scores of the group without physical training are slightly lower than the scores of the group with physical training.

TABLE 2
ARMY PHYSICAL FITNESS TESTS*

Companies with Physical Training							
	Company No. 3 189 Men		Company No. 4 203 Men		Company No. 6 156 Men		Combined Companies 548 Men
	Pre	End	Pre	End	Pre	End	Pre End
Average Scores	161.5	212.5	151.3	213.4	164.0	200.4	158.4 209.4
Range of Scores	9-344	43-368	10-315	82-337	2-338	1-333	2-338 1-368
Companies without Physical Training							
	Company No. 1 203 Men		Company No. 2 188 Men		Company No. 5 193 Men		Combined Companies 584 Men
	Pre	End	Pre	End	Pre	End	Pre End
Average Scores	149.6	183.0	136.9	179.0	155.0	187.6	147.3 183.3
Range of Scores	19-314	47-366	8-298	22-349	3-359	15-390	3-359 15-390

*The scores are abstract figures based on performance of five different exercises. Possible range of scores is from 0-500.

The results for the obstacle course are shown in Table 3. Also shown on the table, is the total number of obstacles which were missed by the test subjects. The group without physical training missed a higher number of obstacles than those with physical training, both for the pre-test and the end-test.

TABLE 3

OBSTACLE COURSE*

Companies with Physical Training							
	Company No. 3 189 Men		Company No. 4 203 Men		Company No. 6 156 Men		Combined Companies 548 Men
	<u>Pre</u>	<u>End</u>	<u>Pre</u>	<u>End</u>	<u>Pre</u>	<u>End</u>	<u>Pre</u> <u>End</u>
Average Scores	164.5	156.1	175.0	157.7	167.4	161.1	169.2 158.1
Range of Scores	125-236	112-214	121-281	115-227	124-239	122-219	121-281 112-227
Obstacles Missed	14 1/2	14 1/2	21 1/2	21	40	25	76 60 1/2
Companies without Physical Training							
	Company No. 1 203 Men		Company No. 2 188 Men		Company No. 5 193 Men		Combined Companies 584 Men
	<u>Pre</u>	<u>End</u>	<u>Pre</u>	<u>End</u>	<u>Pre</u>	<u>End</u>	<u>Pre</u> <u>End</u>
Average Scores	166.6	153.6	163.8	155.9	163.0	161.8	164.5 157.0
Range of Scores		118-229	125-240	121-204	116-236	122-238	116-242 118-238
Obstacles Missed	44	40	51	28	23	31 1/2	118 99 1/2

* The scores are the number of seconds required to cover the course. The obstacles missed are the total obstacles or part of obstacles not negotiated by the test subjects.

Table 4 shows the results of the Five-Mile Speed March. The scores are the number of seconds required for covering the course. The companies without physical training required a slightly longer time than those with physical training, both before and after the basic training cycle.

TABLE 4

FIVE-MILE SPEED MARCH*

Companies with Physical Training							
	Company No. 3 189 Men		Company No. 4 203 Men		Company No. 6 156 Men		Combined Companies 548 Men
	<u>Pre</u>	<u>End</u>	<u>Pre</u>	<u>End</u>	<u>Pre</u>	<u>End</u>	<u>Pre</u> <u>End</u>
Average Scores	4191.8	3854.8	4197.6	3768.7	4107.6	3796.1	4170.0 3806.2
Range of Scores	3004-	2597-	3025-	2696-	2677-	2875-	2677- 2597-
	5950	5305	5568	5428	7148	5929	7148 5929
Companies without Physical Training							
	Company No. 1 203 Men		Company No. 2 188 Men		Company No. 5 193 Men		Combined Companies 584 Men
	<u>Pre</u>	<u>End</u>	<u>Pre</u>	<u>End</u>	<u>Pre</u>	<u>End</u>	<u>Pre</u> <u>End</u>
Average Scores	4258.3	3786.1	4432.0	3925.9	4326.7	3970.2	4336.8 3892.0
Range of Scores	3222-	2704-	3191-	2598-	3232-	3015-	3191- 2598-
	5970	5627	5908	7042	8970	6005	8970 7042

* The scores are the number of seconds required to cover the course.

The differences between pre-test and end-test scores must be compared for the two conditions of training to indicate the effect of the different programs. Table 5 presents the changes which occurred from the mean pre-score to the mean end-score for each company and for the combined companies. In case of the Step Test and the Physical Fitness Test, an improvement is shown by a positive change or increase in numerical value. The obstacle course and the speed march indicated improvement by a negative change, or a decrease in the number of seconds required to transverse the course. Physical training had no appreciable effect on the Step-Test scores-only a slightly greater improvement being shown by the companies without physical training. On the Army Physical Fitness Test and the obstacle course, there was greater improvement shown by companies which had physical training, however on the Speed March, there was a greater improvement shown by the companies which did not receive physical training.

TABLE 5
DEGREE OF IMPROVEMENT SHOWN BY TEST SUBJECTS*

Companies with Physical Training				
	Step Test	A.P.F.T.	Obstacle Course	Speed March
Company No. 3	+15.7	+51.0	-8.4	-337.1
Company No. 4	+20.0	+62.1	-17.3	-428.9
Company No. 6	+14.9	+36.4	-6.3	-311.5
Combined Companies	+17.1	+51.0	-11.1	-363.8
Companies without Physical Training				
	Step Test	A.P.F.T.	Obstacle Course	Speed March
Company No. 1	+17.9	+33.4	-13.0	-472.2
Company No. 2	+19.7	+42.1	-7.9	-506.1
Company No. 5	+14.6	+32.6	-1.2	-356.5
Combined Companies	+17.4	+36.0	-7.5	-444.8

*On the Step Test and the Army Physical Fitness Test, a plus change indicates an increase of score or an improvement. On the Obstacle Course and the Speed March a minus change indicates a decrease in running time in seconds and is an improvement.

IV. DISCUSSION

Examination of the results of the testing program reveals no appreciable differences between the companies receiving physical training and those not receiving formal physical training. Companies which had physical training appeared to have a slightly higher level of physical condition before training began. However, this could be attributed to chance, since there had been no attempt to influence assignment. This slightly greater level of efficiency was carried through the training period to the end-test in about the same amount.

The most significant facts of the testing program are not the scores themselves, but the change in scores which occurred from

the pre- to the end-test. It will be noted that companies with physical training showed a greater improvement in two of the tests, whereas those without physical training showed a greater improvement in the other two tests. In all four tests, however, the degree of difference in improvement between those with and those without physical training was small. In the case of the Step Test, the difference in the two group means was only three tenths of one point. In the case of the Army Physical Fitness Test, the difference between the means of the two groups was 15 points. In the case of the Obstacle Course, the difference in mean time was three and six-tenths seconds. In the case of the Five-Mile Speed March, the difference in mean scores was 81 seconds. None of these differences are statistically significant.

This lack of difference in degree of improvement in physical condition for basic trainees who did and for those who did not have the formal 24 hours of calisthenics may be partially explained by two factors. The work-load of the basic training cycle itself is very heavy. Many of the activities required of trainees as part of the military training are of a strenuous nature, much more so than would normally be required in calisthenics or formal physical training. This is a positive reason. The other is a negative one. In many companies the physical training program is not pushed to its maximum effectiveness, either for lack of interest and initiative on the part of the leaders who are charged with the actual administration of the physical training program, or because of a pronounced tendency to permit administrative interference to greatly reduce the number of men available for physical training.

The Harvard Step Test showed a marked similarity between the groups with and without physical training, both in combined company change and in the change in individual companies. The range of scores within all companies was also rather similar, both high and low scores being equally distributed at pre- and end-test. It is believed that this is the most valid test of physical condition which was applied during this study. The test score is based upon the heart rate following exercise and, as such, is to a great degree independent of the subject's motivation. Previous experience has indicated the Harvard Step Test to be relatively free of error, both in its administration and in scoring.

The Army Physical Fitness Test showed the greatest difference in degree of improvement. The companies which had physical training showed the greatest improvement. This could have been anticipated and may be explained as follows. Several of the exercises (push-ups, sit-ups, and squat-jumps), given as part of the physical

training, are the identical exercises on which the Army Physical Fitness Test is based. It would be expected that men who had actually performed these exercises as part of the physical training program would show improvement because of practice on the specific exercises. The companies which did not have physical training did not have practice on these specific exercises. Even so, the difference in improvement in the two groups was only 15 points, which is fairly small.

In the Obstacle Course, all companies improved their scores, however, the range of improvement varied from one and two-tenths seconds for Company No. 5 to seventeen and three-tenths seconds for Company No. 4. Observations indicated that Company, No. 4, with physical training, was a rather highly motivated company and, with the exception of the Five-Mile March, showed the highest improvement on all tests. This is a direct reflection of the attitude and influence of a very active company commander and a basic training cadre who had a real interest in the company and who were giving continual and energetic encouragement to the trainees during the entire testing program. It was recognized that this could be a factor in producing a difference in the testing program. One of the conditions of the experiment required that no attempt be made either to encourage or discourage physical training, since such conditions will occur throughout any training unit and in any training division, and, because of their existence, will have a marked influence on the result of the physical training program. This study attempted to evaluate the conditions as they were found, not as they could be set up on an ideal basis.

The Five-Mile Speed March proved a very severe test of the man's condition and, probably more than any other test, was influenced by personal motivation. All companies improved their performance.

The question of motivation in general is the prime complicating factor in any attempt at evaluation of physical condition. However, it is believed that the trainees were motivated to the same degree each time they took the test. Some men obviously exerted themselves to the maximum on their initial, or pre-training period. With an occasional exception, these same men tried equally hard at the end-test. There were other men who did not try to produce the maximum scores; many exerted only a minimal effort. Observation indicated that this same group of men continued to give what they believed to be a minimal effort at the end of training. They often did much better because of an improvement in physical condition.

The improved scores of these men were believed to be due to an improvement in general physical condition without any appreciable change in motivation. These conclusions are based on close observation of a large number of test subjects.

One factor which tended to reduce the mean improvement shown by all companies was the presence of men in the companies who were in excellent physical condition at the time the pre-tests were given. These men showed little improvement, while the man in poor condition at the beginning of training showed the greatest improvement even though the final scores were not very good.

There is no question of the value of a formal calisthenics program for improving physical condition where no other appreciable exercise is given. This would apply especially to men in any sedentary-type occupation. However, during a program of such a strenuous nature as the basic infantry training cycle, twenty-four periods of formal calisthenics or physical training are of no consequence in producing improvement in physical condition. There may be other reasons of value in the physical training program, such as teaching coordinated mass action, the ability to respond to commands, and maintaining rhythm of movement with the group. However, this is of secondary value and has little relation to change in physical condition.

V. CONCLUSION

The results of this study have lead to the conclusion that there is no significant difference in degree of improvement of physical condition of basic trainees who have had formal physical training and those who have not had formal physical training during an eight week's basic infantry cycle within the Third Armored Division at Fort Knox, Kentucky.

VI. RECOMMENDATIONS

1. Further evaluation should be made of the effectiveness of the 24 periods of formal physical training normally allotted within an 8-week basic infantry cycle.
2. It is recommended that either the 24 periods of calisthenics be dropped from the physical training program, or that their intensity be increased sufficiently to produce a possible significant change in physical condition.

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